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## Natob—A New Bush Lespedeza For Soil Conservation

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### CONTENTS

	Page		Page
Origin of Natob lespedeza.....	2	Yield and size of seed.....	7
Vegetative characteristics.....	3	Insects and diseases.....	8
Winter hardiness.....	3	Erosion control values.....	8
Flowering and seed maturity.....	5	How to establish a Natob	
Range of adaptation.....	6	planting.....	9

**N**ATOB<sup>1</sup> lespedeza is an early maturing, hardy, geographic strain of common *Lespedeza bicolor*, a native of China, Japan, Korea, and Manchuria. A number of introductions of common bicolor have been made by the United States Department of Agriculture at various times as far back as 1897. The species was considered only as an ornamental until the early 1930's, when technicians of the Soil Conservation Service recognized its value for soil conservation purposes.

The biologists saw in it not only a good erosion-control plant but an excellent wildlife shrub—the plant affording good cover and the seeds furnishing ideal food for game birds, especially quail.<sup>2</sup> As a result, bicolor has become one of the most popular woody plants to be utilized in conservation farming within its range of adaptation. Unfortunately, the season of seed maturity of common bicolor is such as to preclude its use for wildlife food where early frosts occur. Usually the seed does not ripen before the middle to the last of October. This

<sup>1</sup> The name "Natob" is an abbreviation of National Observational Nursery. It is considered appropriate as representing the agency first to observe the superior qualities of this new natural strain of bicolor.

<sup>2</sup> DAVISON, VERNE E. BICOLOR LESPEDEZA FOR QUAIL AND SOIL CONSERVATION IN THE SOUTHEAST. U. S. Dept. Agr. Leaflet 248, 8 pp., illus. 1948.

means that the use of common bicolor must be confined to the South where killing frosts do not occur until later. Finding this Natob strain makes possible the extension of the use of bicolor to areas much farther north.

### ORIGIN OF NATOB LESPEDEZA

Seed of Natob lespedeza was obtained by the writer in 1941 from the Morton Arboretum of Lisle, Ill., where it had been grown for several years as an ornamental. The first planting at the National Observational Nursery, Beltsville, Md., was made from seed in 1942. Grown in comparison with common bicolor and other shrub types, its favorable qualities were soon observed. The seed originally was presented to the Morton Arboretum in 1923 by Joseph Hers, a Belgian official of the Lunghai Railroad in China.

Concurrently, a matching botanical specimen was placed with the Arnold Arboretum, Jamaica Plain, Mass. This specimen (No. 2040) bears a notation to the effect that the actual collection was made by a Chinese railroad inspector, Tchuang Kieh, in September 1922 at Wu Chai Hsien, Shansi Province, China, at an elevation of 6,000 to 9,000 feet. The specimen was identified as a form of *Lespedeza bicolor* in 1926 by A. K. Schindler. From flowering material produced at



FIGURE 1.—Typical terrain in northwestern Shansi Province, China, where the seed of Natob lespedeza originally was collected.



Beltsville, this identification was confirmed by Percy L. Ricker of the Division of Forage Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, United States Department of Agriculture.

Wu Chai Hsien, where seed of this strain was originally collected, is in the northwestern part of Shansi Province near the headwaters of the Fen River, a tributary of the Yellow. The climate of this part of China, according to Lowdermilk,<sup>3</sup> is characterized by cold, dry winters and short growing seasons. In this general area, only remnants of the original vegetation are left and erosion is severe (fig. 1).

Kung,<sup>4</sup> in discussing the lespedezas of North China, noted that *L. bicolor* usually is found growing on open mountain slopes, and states: "This species [has] various forms, but in North China it is scarcely to be separated into varieties." These facts bear significantly upon the characteristics and adaptation of Natob in this country. Undoubtedly, the local environmental factors of its native habitat gave to Natob the fixed, differentiating qualities of hardiness and early maturity required for its use in the colder sections of the United States, in which the growing season is relatively short.

## VEGETATIVE CHARACTERISTICS

Natob lespedeza is a large, leguminous, deciduous shrub. Allowed to grow naturally it reaches a height of 8 to 10 feet. The stems are an inch or more in diameter at the base and well branched (fig. 2). If cut back near the ground, however, the shrub produces numerous stems of lesser diameter and height. Eventually, if not cut back, it exercises the habit of self-pruning in which the older stems gradually die back to the ground and are replaced by new wood. The plant contains an abundance of reserve basal buds which insure good recovery in case the first tender growth of spring is injured by frost. The abundant trifoliate leaves are oval-shaped, about 1½ inches long and 1 inch wide. In general appearance the growing plant is similar to common bicolor except that the leaves are lighter green and the bark of first-year wood is more brownish. The plant is not taprooted but has a heavy, much-branched root system (fig. 4).

## WINTER HARDINESS

Natob is more winter-hardy than any of the other bush lespedezas grown in this country. With a minimum temperature of  $-15^{\circ}$  F. at Beltsville in 1942, only the tips of the branches of Natob were

<sup>3</sup> LOWDERMILK, W. C. FORESTRY IN DENUDED CHINA. Amer. Acad. Polit. and Social Sci. Ann. 152: 127-152. 1930.

<sup>4</sup> KUNG, H. W. LESPEDEZA OF NORTH CHINA. Chinese Jour. Bot. 1: 19-34. 1936.



FIGURE 2.—Six-year-old plants of *Natob lespedeza* which were allowed to grow without being cut back: *A*, Plant in flower and full leaf; *B*, appearance of plant later in the season. The seed crop is about ripe and many leaves have fallen from the top branches.

injured, whereas the tops of all the other bush lespedezas under test, including common bicolor, were killed to the ground. In 1943, with a minimum temperature of  $-5^{\circ}$ , Natob sustained no injury, whereas common bicolor and the other bush types were killed back completely (table 1).

TABLE 1.—*Comparison of seed maturity and winter injury of common bicolor and Natob lespedezas at Beltsville, Md., 1942-47*

Year	Date of first killing frost	Seed maturity		Minimum winter temperature	Winter injury	
		Bicolor	Natob		Bicolor	Natob
1942---	Sept. 30	None----	F u l l y mature.	$^{\circ}F$ -15	Killed to ground.	Tips killed.
1943---	Oct. 11	do-----	do-----	-5	do-----	None.
1944---	Oct. 16	do-----	do-----	5	None-----	Do.
1945---	Oct. 4	do-----	do-----	-6	Killed to ground.	Tips killed.
1946---	Nov. 13	F u l l y mature.	do-----	-2	Tips killed.	None.
1947---	Sept. 26	None----	90 per cent.	-12	Killed to ground.	Tips killed.

## FLOWERING AND SEED MATURITY

Natob lespedeza has the acquired habit of blossoming and maturing seed early, a trait which undoubtedly is attributable to the short growing season of its native habitat. Usually, the flowers appear first in late June and early July and continue to form for 4 to 6 weeks. This is at least a month earlier than common bicolor. For example, while Natob began flowering at Beltsville in 1944 on July 7, common bicolor did not begin until August 20. Flowers and fruit form on the new wood with the extension of lateral branches from the main stem. The flowers, pinkish purple in color, remain open only 1 day. They are mostly self-sterile, being pollinized mainly by honeybees and bumblebees. In tests at Beltsville, only a few seeds set when insects were excluded from all or parts of flowering plants.

The outstanding quality of Natob is its habit of maturing its seed at an early date. At Beltsville, where the first killing frost usually occurs between October 1 and 15, there has not been a seed-crop failure during the 8-year period (1942-50) in which the seeding habit of this strain has been under observation. In the same period common bicolor matured only one seed crop. This was produced in 1946, a year in which killing frost did not occur until November 13. The



time of seed maturity of Natob varies slightly from year to year depending upon the dryness of the season, but usually the seed crop is ready to harvest by early October. For example, the seed in 1944 and 1945 was dry-ripe and harvested by October 5, in 1946 by October 9. Table 1 shows, for Natob and common bicolor, the stage of seed maturity at the time of the first killing frost each year over a 6-year period.

It has been observed that cutting back the plants to facilitate use of the combine in seed harvesting has the effect of retarding seed maturity. At Beltsville the seed crop of the recovery growth resulting from complete top removal during the dormant season was a week to 10 days later in ripening than that of undisturbed plants. Seed ripening is characterized by a yellowing of the leaves which usually begins by mid-September.

Although the seed of Natob generally ripens very early, there is considerable variability in the specific time of maturity and the productivity of individual plants. Also, the seeds shatter readily, an unfavorable characteristic in areas subject to early snow cover. Usually 80 to 90 percent of the seeds fall by the first of January. Efforts are being made to overcome these disadvantages by the perpetuation of distinctively early, highly productive, persistent-fruited plants.

### RANGE OF ADAPTATION

Natob is adapted for use north of the limit of adaptation of common bicolor. Basing adaptation mainly upon the average date of the first killing frost in the fall, as reported by Kincer,<sup>5</sup> the adapted area includes most of the eastern United States north of Virginia, Tennessee, and Arkansas, except northern New England, certain areas along the Canadian border, and the Allegheny Mountains. Field trial plantings are being made to determine specifically the areas of adaptation within this general range.

An indication of the adaptation range of Natob northward, as reported by Frank Edminster, regional biologist of the Soil Conservation Service, Northeastern Region, is the fact that in 1950 mature seed was collected from two plantings in Vermont within 50 miles of the Canadian border—one at 400 feet and the other at 1,000 feet in elevation. Farther west, plantings at the Manhattan (Kans.) Nursery and at the Albuquerque (N. Mex.) Nursery have made good growth and matured seed crops.

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<sup>5</sup> KINCER, J. M. TEMPERATURE, SUNSHINE, AND WIND. In *Atlas of American Agriculture*, Pt. ii, Climate, Sec. B, U. S. Department of Agriculture, 34 pp., illus. 1928.



## YIELD AND SIZE OF SEED

No large-scale field plantings of Natob are yet available from which definite data on seed yields may be obtained. Based on plot trials at Beltsville, however, seed production of this strain compares favorably with that of common bicolor. Two 20-foot rows of the original accession were planted at Beltsville in 1942, and the plants were allowed to grow to full size. In order to determine the effect of top removal on seed yield as related to combine harvesting, one row was cut back to the ground in early spring and the other allowed to remain undisturbed. The calculated yield per acre for a typical year (1947) of the cut-back row was 345 pounds and of the undisturbed row 385 pounds.

For a perennial shrub, Natob starts producing seed at an early age. At Beltsville a light seed crop was produced the first year from 1-year-old transplants, and good seed crops have been produced in each succeeding year.

Although the seeds of Natob are similar in shape and color (mottled brown) to those of common bicolor, they are 40 to 50 percent larger (fig. 3). This difference in size is reflected by a seed count which showed Natob to contain about 64,000 seeds per pound and common bicolor about 85,000.

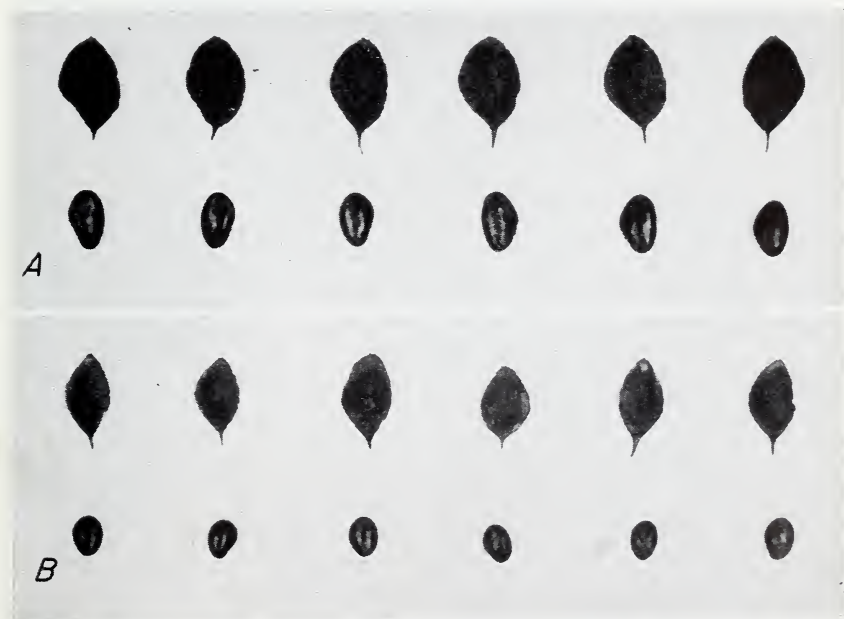


FIGURE 3.—Relative size of the seeds and seed pods of Natob and common bicolor, both about six times natural size: A, Natob; B, common bicolor.

## INSECTS AND DISEASES

No insects or diseases have been observed to seriously affect *Natob* except the Japanese beetle, which attacks both the leaves and flower parts and seems to prefer the tender flower buds. Spraying with DDT two or more times during the season, depending upon the frequency of washing rains, seems to control this pest effectively. A standard formula is 1 pound of 50-percent DDT and 1 pint of insecticide soap spreader to 50 gallons of water. Spraying does not seem to affect the size of the seed crop, as new flowers for insect pollination open every day during the blossoming period. Although DDT has been found lethal to some bees, it apparently did not repel the pollinizers of this *lespedeza*. Since the lethal effect of DDT is by contact, the possibility of injury to pollinizing bees is minimized by spraying late in the day when fewer bees are around. Some of the newer insecticides reported to be less toxic to pollen carriers are worthy of trial in the control of the Japanese beetle on the bush *lespedeas*.

## EROSION CONTROL VALUES

The compact, tenacious, well-noduled root system (fig. 4) and good litter-producing qualities (fig. 5) make *Natob* an excellent erosion-



FIGURE 4.—Cross section of root system of 4-year-old plant of *Natob*. The soil has been partly washed away, exposing the root area to a width of 4 feet and a depth of 2 feet.





FIGURE 5.—Section of row of Natob lespedeza in winter, showing stem development of 5-year-old plants that were mowed the preceding spring. The accumulation of leaf litter is 3 inches deep.

control plant. Wherever it is planted—in field borders and gullies or on embankments and hillsides—it gives a good account of itself in soil building and retention. This plant, like the closely related common bicolor, is also highly useful in supplying food and cover for wildlife.

## HOW TO ESTABLISH A NATOB PLANTING

Natob plantings are established in the same manner as those of common bicolor—by sowing the seed or transplanting nursery-grown, 1-year-old seedlings (fig. 6). The best time to plant is in the spring just after the danger of killing frost is past. The seed coat is hard and must be scarified for successful germination. Because of the simplicity of mechanical scarification, this method is preferable. Acid treatment is also satisfactory. In this method, the seed is kept immersed in full-strength sulfuric acid and frequently stirred (to prevent heating) for a period of 30 minutes. The seed is then washed free of the acid and dried sufficiently for planting. A well-prepared, firm seedbed is essential.

Like common bicolor, Natob is well suited to row planting. In row plantings of seed, the distance between rows and the rate of seed-



FIGURE 6.—Planting of *Natob lespedeza* in its third growing season. It was established from 1-year-old seedlings, transplanted to rows 5 feet apart and 18 inches apart in the row.

ing are determined by the purpose of the planting. For the production of 1-year transplants, a row spacing of 3 feet and a seeding rate of 20 to 30 seed per foot make for satisfactory cultivation and stock development. For permanent row plantings a spacing of 4 to 5 feet between rows and a lighter seeding rate (10 to 15 seed per foot of row) are required to accommodate the mature plants. The seed is sown in shallow furrows and covered about  $\frac{1}{2}$  inch deep. A garden type of planter has proved very satisfactory for seeding purposes.

In developing row plantings by the use of transplants the seedlings are spaced 24 to 36 inches apart in the row.

Unless the soil is fertile, a liberal application of fertilizer high in phosphoric acid and potash should be applied either before or at the time of planting. Row plantings require sufficient cultivation the first and second years to control weeds. Thereafter, growth of the lespedeza is sufficiently strong to prevent weed competition. To insure continuously satisfactory growth and seed yields, a yearly application of fertilizer usually is necessary in the early spring.















